System for collection, transportation and delivery of drill cuttings

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Abstract of **GB2369135**

A method for handling drill cuttings with a fluid content up to 40% by volume comprises transferring the cuttings to a storage container <B>7</B> at the drilling site <B>1</B>, removing the drill cuttings from the storage container <B>7</B> using an excavator <B>33</B> attached to a conveyor <B>34</B> and transferring the drill cuttings to a transportation container <B>9</B> or <B>10</B> on or within a ship <B>8</B>. The drill cuttings are delivered to a treatment site, where they are removed from the transportation container <B>9</B> or <B>10</B>, and transferred to a storage container at the treatment site.

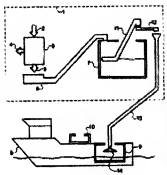

Fig 1

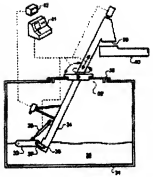

Fig 3

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WO 00/37803 A1

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(54) Abstract Title
System for collection, transportation and delivery of drill cuttings

(57) A method for handling drill cuttings with a fluid content up to 40% by volume comprises transferring the cuttings to a storage container 7 at the drilling site 1, removing the drill cuttings from the storage container 7 using an excavator 33 attached to a conveyor 34 and transferring the drill cuttings to a transportation container 9 or 10 on or within a ship 8. The drill cuttings are delivered to a treatment site, where they are removed from the transportation container 9 or 10, and transferred to a storage container at the treatment site.

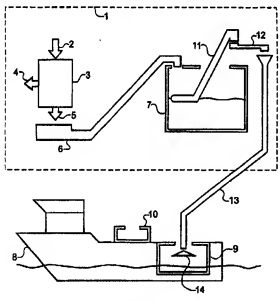

Fig. 1

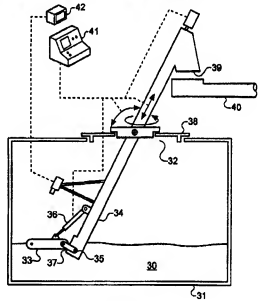

Fig. 3

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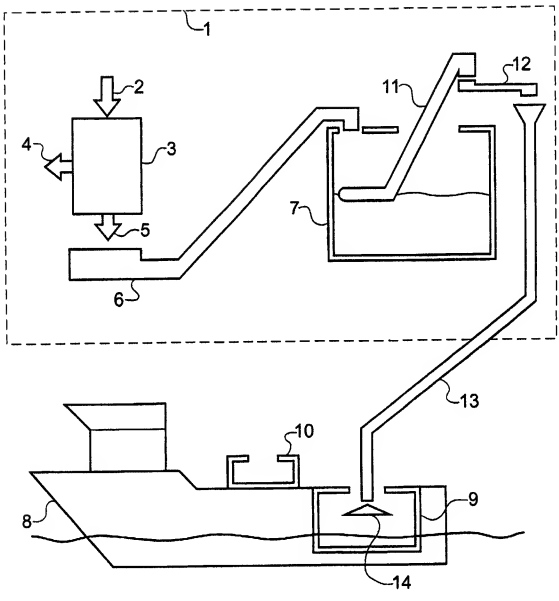

Fig. 1

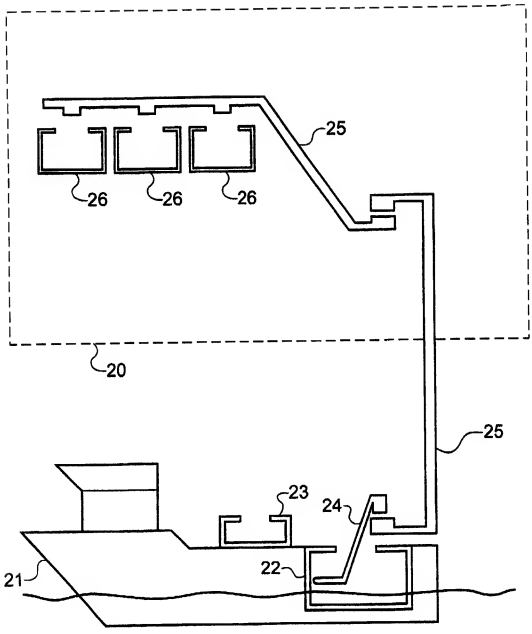

Fig. 2

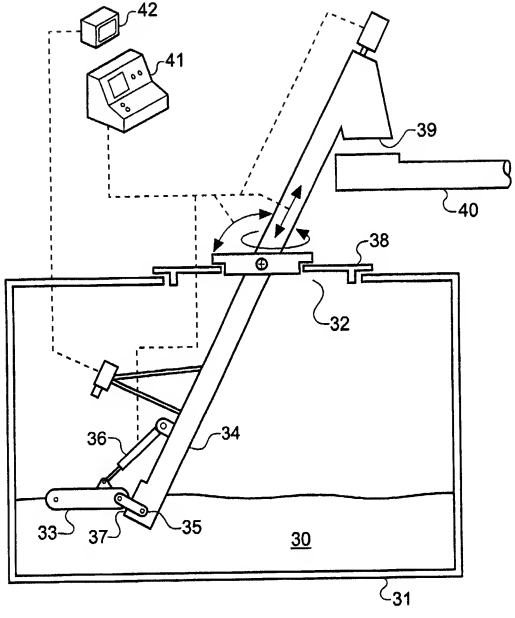

Fig. 3

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SYSTEM FOR THE COLLECTION, TRANSPORTATION AND DELIVERY OF DRILL CUTTINGS

The process of drilling boreholes for the production of oil or gas from a subterranean reservoir generates waste material in the form of rock chippings, known as drill cuttings. During the drilling process such drill cuttings may be contaminated with hydrocarbons and chemicals which are considered to adversely affect the environment. The contaminated drill cuttings form a glutinous mass, particularly if the rock particles include hydroscopic shales which absorb some of the contaminating liquids to form a very soft and sticky outer layer. One method of safely disposing of the drill cuttings is to transport them to a treatment plant where the rock chippings are separated from the contaminants. Typically such treatment plants will also endeavour to recover as much of the hydrocarbons as possible for further use.

The usual method of transporting the contaminated drill cuttings between the drilling site and the treatment plant is by placing the material in special metal containers, each typically holding approximately 5.0 tonnes of material. This system has a number of disadvantages: firstly each container weighs nearly as much as the contents and the special design for containment of the material is expensive. Secondly a typical well might produce enough drill cuttings to fill about 100 containers, giving a problem of storage and taking much time to load onto transport. Thirdly the standard method of emptying such containers is by tipping them upside-down, which is an operation involving some risk to personnel.

A second method of transporting the contaminated drill cuttings between the drilling site and the treatment plant is by transferring the material into a few larger containers which are too heavy to lift by offshore crane and may be located, by way of example, on or beneath the deck of a marine vessel. It has been observed that during transportation the liquid phase, being mainly hydrocarbons and water, becomes separated from the solid phase as a result of vibration, and the solid phase becomes compacted at the bottom of the container.

Existing operators have sought to transfer the material from the large containers to the treatment plant, which may be a distance of 100 metres or more, by means of a pump. The material can only be pumped if a high proportion of liquid is present and homogenised with the drill cuttings, as noted in Patent Application Nos. GB 2339443, GB 2330600, WO 0037803, and WO 0045028. In spite of claims to the contrary, observations and extensive testing by the Applicant has found that typically 50-65% liquid is required to permit the material to be pumped. Such liquid is to the detriment of the subsequent drill cuttings cleaning process. Furthermore the process of homogenisation has proved to be very difficult once separation and compaction has occurred, even when using a pump with a shaft mounted disintegrator tool as described in Patent Application No. WO 0037803. Typically this difficulty is made worse by the limited size of the openings which provide access into the transportation containers. It has also been observed that the processes of homogenisation by agitation, and of the act of pumping, causes the material to increase in viscosity through a reaction between the rock particles and the contaminating liquids.

Those skilled in the art of pumping will recognise that such material does not behave as a Newtonian fluid and therefore is not suited to this method of transfer.

When the contaminated drill cuttings are separated from the drilling fluids by the solids control equipment as part of the drilling process they are relatively dry, but fluid is then added to the material in order to facilitate transfer to the transportation containers.

An object of the present invention is to provide a means by which contaminated drill cuttings can be transferred from the solids control equipment at the drilling site to the treatment plant with minimum handling by, and risk to, personnel involved in the process, and with the minimum liquid content to ensure optimum performance of the treatment plant.

In accordance with a first aspect of the present invention, a system for the collection of drill cuttings at the drilling site comprises a means for transferring the contaminated drill cuttings to storage or transportation containers at the drilling site; a means of recovering contaminated drill cuttings from the storage container; and a means for transferring the contaminated drill cuttings to the transportation container on or within a transportation means.

In accordance with a second aspect of the present invention, a system for the delivery of drill cuttings to the treatment site comprises a means for recovering compacted contaminated drill cuttings from the transportation container; and a means for transferring the contaminated drill cuttings to the treatment site storage containers.

In accordance with a third aspect of the present invention, a system for the recovery of contaminated drill cuttings from transportation and storage containers comprises means for excavating drill cuttings without pumping; means to move the excavation device in three dimensions within the container; and a means to remove the excavated material from the container

The excavating means may, for example, be an air transfer system, a screw conveyor or a vacuum transfer system. However, most preferably the excavating means is a mechanical excavator, so that drill cuttings having a fluid content of up to 40% by volume, which are difficult to pump, can be excavated without difficulty and without the need for separate mechanical agitation.

It will be appreciated that at even lower fluid content or when the solids have separated from the fluid component, the drill cuttings cannot be pumped at all. However, lower fluid content makes the cuttings easier and cheaper to process. Therefore preferably, the drill cuttings have a fluid content of up to 30% by volume.

The drill cuttings are most preferably initially handled in the substantially dry state in which they are ejected from the solids control equipment which removes the drilling fluid from the drill cuttings, so that the drilling fluid can be returned to the bore hole.

Preferably the system is controlled by personnel located outside the transportation container.

Preferably a means is included to communicate the location and orientation of the excavation device to operating personnel located outside the transportation container.

Preferably a means is included to remove any separate liquid phase from the surface of the compacted contaminated drill cuttings within the transportation container prior to commencement of excavation of the solid phase.

An embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:-

FIGURE 1 is a block diagram illustrating a collection system in accordance with a first aspect of the present invention.

FIGURE 2 is a block diagram illustrating a delivery system in accordance with a second aspect of the present invention.

FIGURE 3 is an illustration of a container emptying system in accordance with a third aspect of the present invention.

DESCRIPTION OF COLLECTION SYSTEM (figure 1)

Enclosure (1) delineates the part of the system which is located at the drilling site. The drilling fluid (2) carries the contaminated drill cuttings from the wellbore to the solids control equipment (3), which separates the reusable drilling fluid (4) from the contaminated drill cuttings (5). The contaminated drill cuttings are delivered into a conveyor (6), which may, by way of example, be a tube type chain conveyor. The

conveyor (6) delivers the contaminated drill cuttings into storage containers. The storage containers may be portable (not shown) for transportation complete with contents to the contaminated drill cuttings treatment plant site, or permanently installed at the drilling site (7). When it is desired to transport the contaminated drill cuttings from the permanent storage containers (7) to the treatment plant site a transportation means, for example a supply boat (8) will attend the drilling site (1). The transportation means (8) carries transportation containers which may be fitted below the deck (9) or on the deck (10) or in any appropriate manner according to the transport means. The storage container emptying system (11) removes the contaminated drill cuttings from the permanent storage containers (7) and delivers the material to one or a series of loading conveyors (12), which may, by way of example, be a tube type chain conveyor. The loading conveyor (12) transports the contaminated drill cuttings into a loading means (13), which may be an open conduit, screw conveyor, or other suitable means. The contaminated drill cuttings pass along the loading means into the transportation container. A dispersal means (14) may be used to ensure even distribution of contaminated drill cuttings within the transportation container.

DESCRIPTION OF DELIVERY SYSTEM (Figure 2)

Enclosure (20) delineates the part of the system which is located at or adjacent to the contaminated drill cuttings treatment plant. A transportation means, for example a supply boat (21) will attend the treatment plant site (20). The transportation means (21) carries transportation containers which may be fitted below the deck (22) or on the deck (23) or in any appropriate manner according to the transport means. The transportation container emptying system (24) removes the contaminated drill cuttings

from the transportation containers (22) or (23) and delivers the material to one or more conveyor(s) (25), which may, by way of example, be tube type chain conveyors. The conveyor(s) (25) transport the contaminated drill cuttings into one or more storage containers (26) at the treatment plant ready for processing.

DESCRIPTION OF CONTAINER EMPTYING SYSTEM (Figure 3)

The contaminated drill cuttings (30) are located in the container (31) which may be a storage container or a transportation container. Access to the container (31) is by means of an opening (32), which is shown, by way of example, in the top of the container. An excavator (33) is attached to a conveyor (34) by means of an articulated joint (35). By way of example, the excavator (33) may be a conveyor excavator comprising a series of dredging/digging buckets or teeth equidistantly spaced around the outside of an endless chain or belt which is driven around a support which may comprise sprockets or rollers. The buckets or teeth scoop or scrape the drill cuttings to the conveyor (34) which is, for example, a tube type chain conveyor. The position of the excavator (33) relative to the conveyor (34) may be adjusted, for example by means of a hydraulic cylinder (36) which rotates the excavator (33) about the articulated joint (35). The excavator (33) moves the material to an inlet opening (37) in the conveyor (34). The conveyor (34) is carried on mounting frame (38) which may be fitted into the opening (32) or on the upper outside surface of the container. The conveyor (34) can rotate within the mounting frame (38) and can be raised and lowered independently of the mounting frame (38). The contaminated drill cuttings are discharged from the conveyor (34) through an outlet (39) which might, by way of example, be connected to another conveyor (40) for transportation to the next part of the transportation system. A control system (41) provides an operator with

control over the speed and position of the excavator and the conveyor. Monitoring means is provided to inform the operator of the position of the excavator in the container which may, by way of example, be a closed circuit TV system (42) or one or more sensors which sense the position of the excavator (33) in the container (31).

CLAIMS

1. A method for the handling of drill cuttings at a drilling site, the drill cuttings having a fluid content of up to 40% by volume, the method comprising the steps of:

transferring the drill cuttings to a storage container at the drilling site;

removing the drill cuttings from the storage container;

transferring the drill cuttings to a transportation container on or within a transportation means.

2. A method for the delivery of drill cuttings having a fluid content of up to 40% by volume to a treatment site comprising removing the drill cuttings from a transportation container; and transferring the drill cuttings to a storage container at the treatment site.

3. Apparatus for the removal of drill cuttings from a container comprising mechanical excavator means for excavating drill cuttings within the container; means for moving the excavating means within the container; and means for removing the excavated material from the container.

4. Apparatus as claimed in claim 3, in which control means is provided externally of the container, for controlling the excavating means.

5. Apparatus as claimed in claim 4, further comprising means for communicating the location and orientation of the excavation device to the said external control means.

6. Apparatus as claimed in any one of claims 3 to 5, in which means is provided to remove any separate liquid phase from the surface of the compacted contaminated drill cuttings within the container prior to commencement of excavation of the solid phase.

7. Apparatus as claimed in any one of claims 3 to 6, in which the excavating means comprises a mechanical excavator having a plurality of buckets or teeth supported on an endless drive member.

8. A method substantially as described herein, with reference to the accompanying drawings.

9. Apparatus substantially as described herein, with reference to and as shown in the accompanying drawings.

Application No: GB 0027916.6 **Examiner:** Eleanor Wade
Claims searched: 1 **Date of search:** 21 February 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): E1F FGM

Int Cl (Ed.7): E21B

Other: Online: EPODOC, WPI, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO 0045028	(Halliburton Energy Services) whole doc.	1
X	WO 0037803	(DeJager V) Page 8 lines 14-22	1
X	WO 9922113	(Bailey) see Fig. 1 and page 4, second paragraph	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.